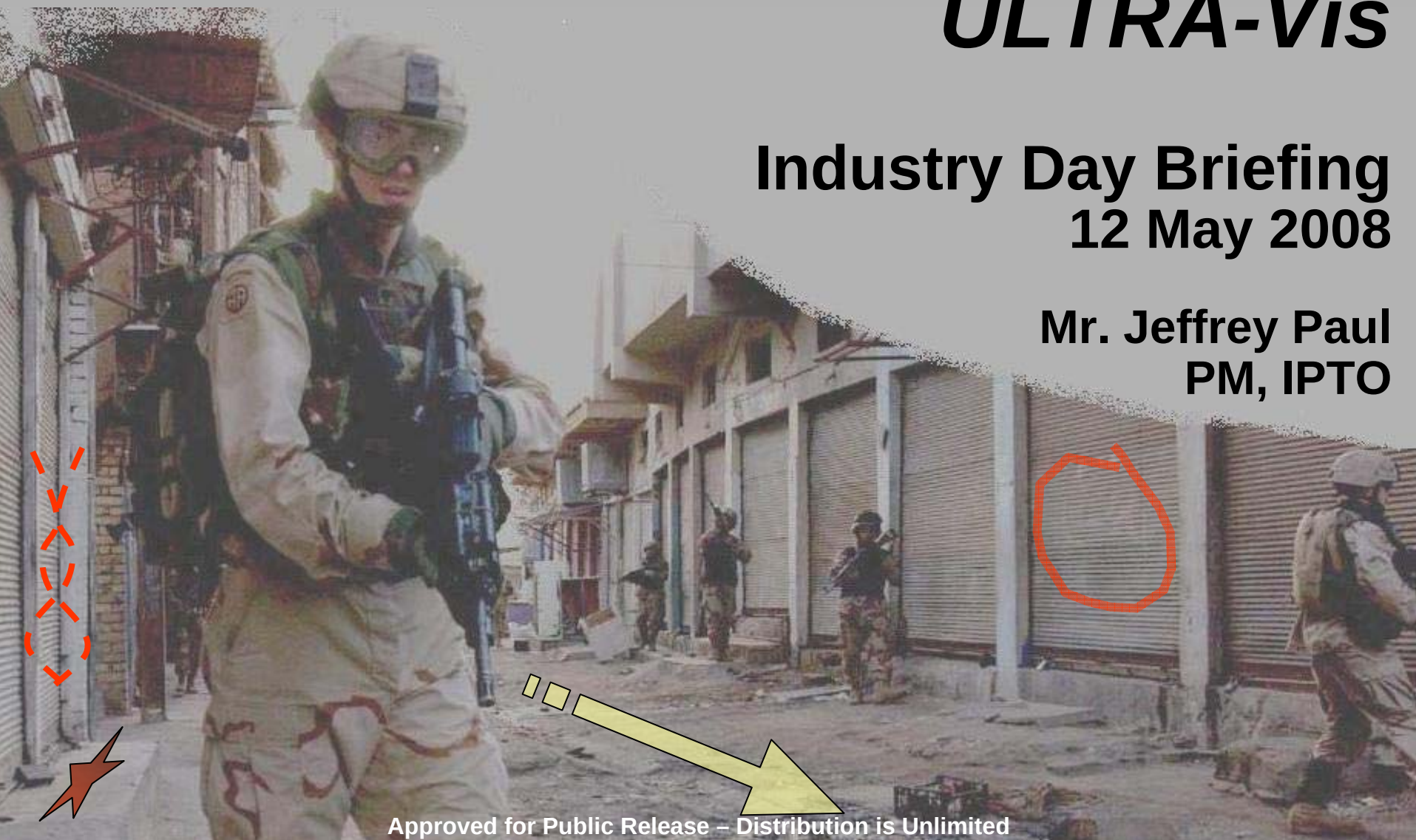
# Urban Leader Tactical Response, Awareness & Visualization

# *ULTRA-Vis*

## Industry Day Briefing
## 12 May 2008

**Mr. Jeffrey Paul**
**PM, IPTO**



# Industry Day Agenda

**0900 Opening Remarks (Mr. Jeffrey Paul)**

**0905 ULTRA-Vis Program Overview (Mr. Jeffrey Paul)**

**1000 Contracting (Mr. Stephen Davis )**

**1015 Break**

**1045 Q&A**

**1200 Adjourn**

# ULTRA-Vis Industry Day - Discussions

- This Meeting is held at the UNCLASSIFIED Level only.
- There will be NO CLASSIFIED discussions in this venue.
- The Industry Day Participants include:
  - U.S. Industries
  - DoD Agencies
  - Universities
  - Foreign Nationals

# ULTRA-Vis Program Overview

- **Military Challenge**
- **Program Vision**
- **Key Technologies**
- **Program Structure**
- **Program Metrics**

# Command & Control in Urban Combat
## *... a significant challenge*

## Urban Ops (Current):

- Communicate by shouting & hand signals

- Must operate within earshot and LOS

- Intra-squad radios hard to hear (urban noise, weapon fire)

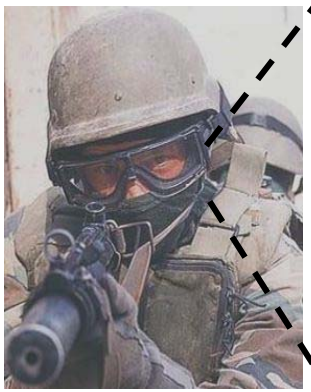
- Must stop to use handheld CDAs (maps, updates)

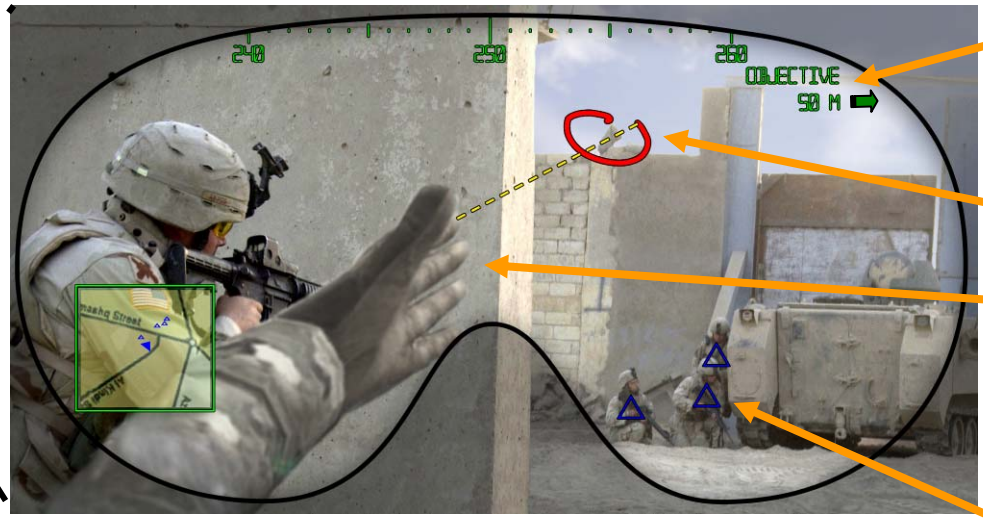
***Small unit coordination inadequate to conduct NLOS, Distributed Operations***

# ULTRA-Vis
## ... A Revolution in Command & Control

**Interpret/disseminate/display time-critical combat information**
***- while looking ahead, hands on weapon, and on the move***

**Icons geo-registered/displayed in real time**






**Orders/alerts overlaid on see-thru display**

**Direct Fire**

**Interpret/mark Leader's gestures/voice commands**

**Display locations of team members**

***Iconic Command & Control… while immersed in the real-world environment***

# *ULTRA-Vis* Operational Scenario



# ULTRA-Vis Program Vision

## The ULTRA-Vis program seeks to provide:

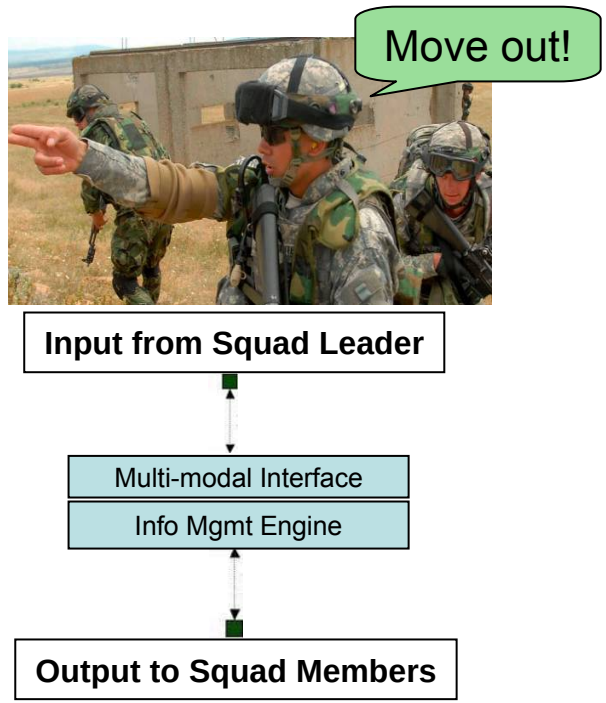
- the small unit leader with hands-free, iconic Command & Control (C2) while immersed in the real-world environment
- revolutionary C2 capability and hand-off of *actionable combat information* at the lowest echelon for situational awareness
- Inter & intra-squad coordination to conduct non-line-of-sight, Distributed Operations

**Integrated command & control system for the Dismount Soldier**

# Key Technologies

## - Adaptive Multi-modal Interface:

- Can use COTS Audio/Visual/Tactile I/O devices for Squad Leader's gestures and commands
- Implement interface with integrated micro laser rangefinder (or other methods) for pointing & marking

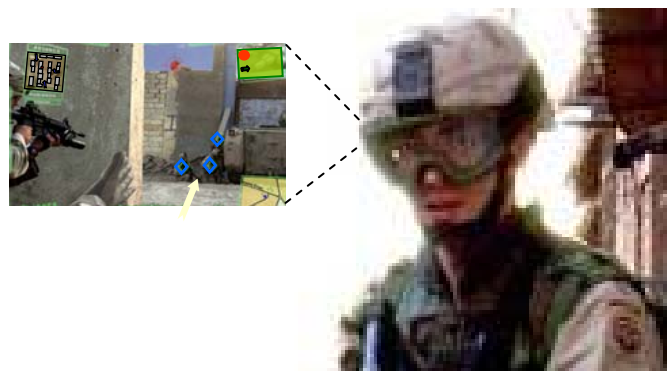



## - Information Management Engine:

- Recognize voice/gestures and create icons from Squad Leader's commands
- Avoid information overload using cognitive models to sort, filter, disseminate information

## - Advanced See-Thru Display:

- Display geo-registered icons in real time on see-thru visor



# Multi-modal Interface

## Multi-modal Input & Interface priorities:


- Integrate sensors meeting geo-reg rqmts (mic/earphones, compass/IMU, GPS, micro-laser rangefinder)
- Develop accurate gesture recognition techniques
- Provide simultaneous interpretation of different command modalities (voice/gesture/tactile)
- Combine geo-registered inputs (head tracking/pose, hand/arm motions, location and position)

**Payoff: NLOS hand-off of actionable combat information**

# Information Management Engine

## Information Management priorities:

"Fire Team 3…Rally Point now!"

- Recognize gestures/voice commands & interpret commands to create icons
- Avoid information overload with situation modeling -- filter info based on activity, status, location
- Disseminate commands and information based on situational priorities (mission, plan, activity, environment, …)

**<u>Payoff:</u> Inter- and intra-squad collaboration for Distributed Operations**

# See-through Visor Display

## See-through Visor priorities:

- High brightness icon overlay
- Three color capability (monochrome, Ph 1)
- Comfortable, low-profile configuration

  -- non-occluding head-mounted display

  (e.g., visor/dust goggle form factor)

**<u>Payoff:</u> Lightweight, low-profile display for User acceptability**

# *ULTRA-Vis* System Architecture (Notional)

Real-time generation, dissemination and display of tactically significant icons for Command & Control of a networked Squad

**Multi-Modal Interface**
**for Command & Control gestures**

→

**Information Management**
**to interpret/create/disseminate icons**

→

**Iconic Display**
**of Squad Leader's commands to Fire Team members**

**On-Board Processor**

- **Gesture/Speech Recognition**
  - **Interpret/record inputs**
  - **Generate icons**
- **Disseminate Tactical Info**
  - **Route/filter alerts**
  - **Merge commands/data**
  - **Render multi-modal data**
- **Icon Placement**
  - **Mark urban landscape**
  - **Track postings/labels**
- **Geo-location/Pose**
  - **Derive coordinates**
  - **Overlay icons**

DRAM Memory
Flash Memory

Network Interface (<100Kbps)

**See-Thru Visor Display**
**Microphone/Headset**
**Gesture Unit**
**Tactile Device**
**Micro Laser Rangefinder**
**Navigation Unit**
**Voice & Data Radio**
**Battery**

**Visor Display**

**Full, natural view (non-occluding) Geo-registered Icons**

Off-board Intel

Databases
Remote Sensors

**Commands**
**Geo-registered icons**
**Contextual Information**
**Alerts**
**New Objectives, New Route**
**Rally Point**
**Fire Team Member Locations**

# ULTRA-Vis Program Structure

**Phase 1: Critical Technology Demonstrations**

- **Task a: Recognize hand and arm signals (gestures)**
- **Task b: Create/display geo-registered icons from different perspectives**
- **Task c: See icons in full sunlight conditions on see-through display**
- **Task d: Conduct system design trade study and CONOPS development**

**Phase 2: Multi-Modal Testbed Demonstrations**

- **Task a: Display icons in 3 colors (R-G-B)**
- **Task b: Integrate multi-modal testbeds for test and evaluation**
- **Task c: Support system test and evaluation**

**Phase 3: System Prototypes for Evaluation/Transition**

- **Task a: Fabricate/test/demonstrate prototype units for transition**
- **Task b: Support Service field evaluation**

***Offerors are encouraged to form strong, multidisciplinary teams to develop an end-to-end integrated system.***

# *ULTRA-Vis* Gate Metrics

| | Gate Rqmt | Operational Metric | Go/No-Go Criteria |
|---|---|---|---|
| Ph. 1 | **Gesture Recognition** | Recognize Leader's Standard Hand & Arm Signals | > 99% probability of correct recognition of at least 10 hand & arm signals<br>< 1% False Alarms |
| Ph. 1 | **Geo-Registered Icons** | Create/display geo-registered icons from Leader's pointing action on two see-thru displays | Placement Accuracy:<br>< 10 mrad, angular accuracy (1m @100 m)<br>< 0.1 m, range accuracy<br>< 0.5 mrad, jitter @ 60 Hz update |
| Ph. 1 | **See-Thru Display** | See icons (monochrome) in full sunlight | ≥2000 Ft-L brightness (monochrome)<br>40° FOV |
| Ph. 2 | **Integrated Multi-Modal Testbed** | Create/disseminate command information using two, networked, Soldier-worn Testbeds with:<br>- Head-Mounted Display - Nav units<br>- Audio interface (mic/headset) - Voice/Data Radio<br>- Hand/Arm gesture interface - Tactile Cueing device | - 3-color (R-G-B) icons, ≥2000 Ft-L, 40° FOV<br>> 99% probability of correct recognition (sender) and representation (receiver) of multi-modal commands (hand/arm gestures + voice)<br>< 1% False Alarms |
| Ph. 3 | **Prototypes** | Demonstrate system functionality with fifteen (15) prototypes for Transition | System weight (including batt.): < 3 lbs<br>System power: < 6 W |

**The feasibility and likelihood of the proposed approach to satisfy the program Go/No-Go metrics must be explicitly described and clearly substantiated.**

# ULTRA-Vis

- All hardware design and fabrication methods, processes and techniques, software, software documentation, source code, and technical data developed under ULTRA-Vis will be provided to the government with a minimum of Government Purpose Rights.
  - Offerors expecting to utilize, but not to deliver, open source tools or other materials in implementing their approach must ensure that the government does not incur any legal obligation due to such utilization.
- Proposals containing proprietary data should have the cover page and each page containing proprietary data clearly marked
- The ULTRA-Vis program will be UNCLASSIFIED.
  - DARPA does not encourage classified proposals in response to this announcement

# Summary

- **ULTRA-Vis…a revolutionary new capability addressing a critical operational problem and is strongly supported by military users**

- **ULTRA-Vis focused on transition to the Services**